

REMARKS

The present invention is a transmitter for a portable communication apparatus and a sub-harmonic mixer. An embodiment of a transmitter for a portable communication apparatus includes a modulator, as illustrated in Fig. 1 including a first port for inputting a baseband signal, a second port for inputting a local oscillator signal, means for rectifying the input local oscillator signal to provide a conductance waveform at a multiple of the local oscillation signal and means for mixing the baseband signal with the conductance waveform at said multiple of the local oscillator signal frequency for up-converting the baseband signal to a radio frequency modulated carrier and the transmitter including means for controlling the gain of the modulator thereby to control the output level of the modulator.

Furthermore, an embodiment of a sub-harmonic mixer in accordance with the present invention includes switching means Q1-Q4; a first port RFP or RFN for inputting a baseband signal to the switching means to be up-converted; and a second port Lo for inputting a local oscillator signal to drive the switching means at an even multiple of the local oscillator frequency for up-converting the baseband signal to transmission frequency.

The present invention provides up conversion of the baseband signal without employing a local oscillator at the carrier frequency with the output of the modulator being variable. See the top paragraph of page 4 of the specification. The local oscillator operates at a sub-harmonic of the transmitted signal frequency with the mixing being performed between the baseband signal and one of the harmonics of the local oscillator which insures that the harmonic is not generated in the

transmitter. See the second paragraph on page 4 of the specification. Moreover, the local oscillator is highly isolated providing modulator control over a large range. See the third paragraph on page 4 of the specification.

Claims 1-3 and 7-9 stand rejected under 35 U.S.C. §103 as being unpatentable over United States Patent 5,568,098 (Horie et al) in view of United States Patent 6,215,989 (Otaka). With respect to claims 1 and 7, the Examiner reasons as follows:

As per claims 1 and 7, *Horie et al* disclose a transmitter for a portable radio device comprising a modulator including a switching circuit, having a first port for inputting a baseband signal and a second port for inputting a local oscillator signal to the switching circuit which provide a conductance waveform at a frequency multiple of the local oscillator signal for up-converting the baseband signal to a radio frequency modulated carrier (fig. 5, col. 3/ln. 58-col. 4/ln. 67).

Horie et al do not explicitly disclose such controls the gain of the modular to control the output level of the modulator. However, such gain control method of the modulator is well known in the art, as disclosed by *Otaka* (fig. 6-10, col. 7/ln. 29-col. 10/ln. 48). Therefore, it would have been obvious to one of ordinary skill in the art to provide such method of gains control, as taught by *Otaka*, to the transmitter of *Horie et al* to control input amplitude signal at an optimum gain level while minimizing the reduction of the S/N ratio.

These grounds of rejection are traversed for the following reasons.

Claim 1 recites a modulator including a first port for inputting a baseband signal, a second port for inputting a local oscillator signal, means for rectifying the input local oscillator to provide a conductance waveform at a multiple of the local oscillator signal and means for mixing the baseband signal with the conductance waveform at said multiple of the local oscillator signal frequency for up-converting the baseband signal to a radio frequency modulated carrier and claim 7 recites

"a modulator including a switching circuit, a first port for input of a baseband signal and a second port for input of a local oscillator signal to the switching circuit which provides a conductance waveform at a frequency multiple oscillation frequency of the local oscillator signal, and a mixer which mixes the baseband with the conductance waveform at the frequency multiple of the local oscillator signal frequency for up-converting the baseband signal to a radio frequency modulated carrier". This subject matter has no counterpart in Horie et al and Otaka. Moreover, claims 1 and 7 recite gain control of the modulation which is also not taught in Otaka for the reasons set forth below.

In the Final Rejection of November 3, 2004, which has subsequently been withdrawn, the Examiner has stated that "[t]he Applicant's stated that 'Horie et al fails to suggest that the claims requires a modulator including means for rectifying the input local oscillator signal provides to a first port to provide a conductance waveform at a multiple of the LO and means for mixing..." and "Otaka do not disclose a modulator with a gain control". "In response to Applicant's argument, the limitations on which the Applicant relies are not stated in the claim." However, a proper reading of claims 1 and 7 reveals that means for rectifying and switching means are part of the modulator and Otaka does not control gain of a modulator

"Horie et al disclose in Fig. 5 a quadrature modulator 18 which modulates a carrier signal produced by a frequency multiplier 17 that is distinct from the modulator. Horie et al do not disclose the specifics of the quadrature modulator and therefore, do not correspond to the claimed means for rectifying and the means for mixing the baseband signal with a conductance waveform within the modulator as

recited in claim 1 and further, the switching circuit and mixer within the modulator as recited in claim 7. While Otaka do disclose a variable gain amplifier, it is seen that with respect to a wireless transmitter of Fig. 11, that the variable gain amplifier 105, is disposed between the RF signal produced by multipliers 102 and 103 and the RF signal produced by up-converter 107. See column 11, lines 40-67, through column 12, lines 1-8. It is therefore seen that Otaka does not disclose "means for controlling the gain of the modulator thereby to control the output level of the modulator as recited in claim 1 and further, a gain control coupled to the modulator, which controls the gain of the modulator to control the output level of the modulator" as recited in claim 7, since the disclosure of gain control in Otaka is not utilized in combination with a modulator to control the gain of the modulator. Instead, the gain control boosts the signal magnitude which is input from the variable gain circuit 105 to the modulator 107.

Accordingly, it is submitted that if the proposed combination of Horie et al and Otaka was made, the aforementioned elements of claims 1 and 7 would not be achieved since Horie et al do not disclose the means for rectifying and the means for mixing of claim 1 and the switching circuit and mixer of claim 7 and further, Otaka does not disclose the means for controlling the gain of the modulator of claim 1 and the gain control which controls the gain of the modulator as recited in claim 7.

Claim 2 further limits claim 1 in reciting a local oscillator signal drives the modulator at a multiple of its frequency. The internal structure of the modulator of Horie et al is not described and there is no basis why a person of ordinary skill in the

art would consider Horie et al to disclose a local oscillator signal which drives the modulator at a multiple of its frequency.

Claim 3 further limits claim 1 in reciting means for controlling the gain of the modulator comprises current control means. Claim 3 is patentable for the same reasons set forth with respect to claim 1.

Claim 8 further limits claim 7 in reciting that the local oscillator signal drives the switching circuit at a multiple of a frequency of the local oscillator. As stated above, Horie et al do not disclose the claimed switching circuit and further do not disclose the relationship of the local oscillator driving a switching circuit at a multiple of the frequency of the local oscillator.

Claim 9 further limits claim 7 in reciting the gain control comprises the current control and is patentable for the same reasons set forth above with respect to claim 7.

Claims 4-5 and 10-11 stand rejected under 35 U.S.C. §103 as being unpatentable over Horie et al and Otaka further in view of the Hickman publication. These grounds of rejection are traversed for the following reasons.

Hickman has been cited as disclosing cross-connected long tail pairs of bipolar transistors. However, Hickman does not cure the deficiencies noted above with respect to the combination of Horie et al and Otaka.

Claims 6 and 12 stand rejected under 35 U.S.C. §103 as being unpatentable over Horie et al and Otaka further in view of United States Patent 6,526,265. These grounds of rejection are traversed for the following reasons.

Claims 6 and 12 respectively recite a sub-harmonic mixer comprising switching means AND a switching circuit, a first port for input of a baseband signal to the switching means to be up-converted; and a second port for inputting a local oscillator signal to drive the switching means or the switching circuit at an even multiple of the local oscillator frequency for up-converting the baseband signal to the transmission frequency.

The deficiencies of the combination of Horie et al and Otaka have been pointed out above and furthermore, with respect to claims 6 and 12, it should be noted that the combination of Horie et al and Otaka do not disclose a sub-harmonic mixer comprising switching means and a first port for input of a baseband signal to the switching means to be up-converted as recited in claim 6 and a sub-harmonic mixer comprising a switching circuit and a first port for input of a baseband signal to the switching circuit to be up-converted as recited in claim 12. Specifically, neither Fig. 5 nor Fig. 6 of Horie et al teach sub-harmonic mixing and further, the transmitter structure of Otaka describes a conventional wireless transmitter-receiver circuit utilizing a heterodyne system as described in column 11, lines 16-67, through column 1, lines 1-8, of Otaka which is not a sub-harmonic mixer.

The Examiner's reliance upon Damgaard et al is misplaced. While Fig. 8 of Damgaard et al does disclose the utilization of a multiplier to shift the modulated local oscillator 318 up by a multiple k , as indicated by block 320, such shifting is applied to a down converter 316 which is utilized as part of the control of the frequency of the voltage control oscillator 308. The utilization of frequency multiplication in a down converter is the antithesis of the claimed up-converting as

recited in claims 6 and 12. It is submitted that a person of ordinary skill in the art would not consider the teachings of Damgaard et al pertaining to the use of a frequency multiplier in a down converter to be relevant to the claimed sub-harmonic mixer which utilizes a local oscillator signal to drive the switching means or switching circuit of claims 6 and 12 at an even multiple of the local oscillator frequency for up-converting the baseband signal to the transmission frequency.

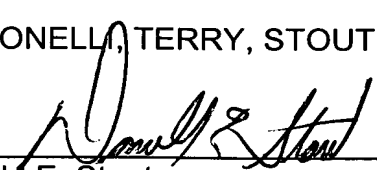
It is submitted that the Examiner is basing the proposed combination upon impermissible hindsight. It is submitted that a person of ordinary skill in the art would not consider combining Horie et al and Otaka with the teachings of Damgaard et al which pertain to down converting to achieve the sub-harmonic mixer of claims 6 and 12 which pertain to up-converting except by impermissible hindsight.

In view of the foregoing amendments and remarks, it is submitted that each of the claims in the application is in condition for allowance. Accordingly, early allowance thereof is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (367.38669X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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